

## The Psocoptera (Insecta: Psocodea) of St Helena and Ascension Island (South Atlantic) with a new record from South Africa

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**The Psocoptera (Insecta: Psocodea) of St Helena and Ascension Island (South Atlantic) with a new record from South Africa.** - Four new species are described: *Cerobasis atlantica* Lienhard sp. n. (Trogiidae) from St Helena, *Sphaeropsocopsis insularum* Lienhard sp. n. (Sphaeropsocidae) from St Helena and Ascension Island, *Indiopsocus mendeli* Lienhard sp. n. (Psocidae) from Ascension Island and *Blaste helenae* Lienhard sp. n. (Psocidae) from St Helena. The latter is closely related to the St Helena endemic *Blaste basilewskyi* Badonnel; this could be an example of sympatric speciation. *Helenatropos abrupta* Lienhard, formerly supposed to be a St Helena endemic, is for the first time recorded from South Africa and its male is described; it may have been introduced to St Helena. The recently published doubtful record of the Mexican species *Cerobasis maya* García Aldrete from Ascension Island is confirmed. The male of the blind cave-dwelling St Helena endemic *Sphaeropsocopsis myrtleae* Lienhard & Ashmole is described for the first time; its genital morphology indicates a close relationship to the African *Sphaeropsocopsis reisi* Badonnel. Several other species are recorded for the first time from one or both of these islands. The number of species recorded from St Helena is raised to 23 (6 endemics), that from Ascension Island to 13 (2 endemics). A checklist of the 27 psocid species recorded from these islands is presented and a brief biogeographical analysis is provided.

**Keywords:** Trogiidae - Sphaeropsocidae - Psocidae - new species - new records - cave fauna - blind psocid - island endemics - island biogeography.

### INTRODUCTION

St Helena and Ascension Island, 1300 km apart and respectively 1800 and 1500 km from continental land, are among the most isolated islands in the world. Similar in size (respectively 122 and 97 km<sup>2</sup>) and in their origin as volcanic oceanic islands formed near the Mid-Atlantic Ridge, they differ dramatically in their age: St Helena is about 14 million years old but Ascension probably emerged only about one million years ago. Study of the biology of this pair of islands offers snapshots of two very different stages in the development of ecosystems in situations so remote that natural

colonization by plants and animals is a rare event and evolution can proceed in isolation. On St Helena, now geologically stable but with heavily eroded coasts and landscapes, processes of phyletic change, the splitting of lineages and interactions among species have created a mature and diverse biota (Ashmole & Ashmole, 1997, 2000a). Ascension, an order of magnitude younger and still with raw volcanic terrain, shows early stages in these same processes, while the paucity of native plants ensures that the low diversity invertebrate fauna is dominated by scavengers and predators.

Knowledge of the psocids of St Helena and Ascension Island has developed mainly as a result of a series of collecting opportunities in the past two decades. In 1995 Philip and Myrtle Ashmole spent five months in field work on St Helena, primarily attempting to find invertebrate species adapted to subterranean life, but with limited success (Ashmole & Ashmole, 2000a: 131-132). More diverse collections of psocids were obtained in 2003, during a survey of invertebrates of Prosperous Bay Plain in connection with the proposed airport (Ashmole & Ashmole, 2004a, 2004b). In 2006 a survey of the invertebrate communities of the Central Peaks of St Helena commissioned by the St Helena National Trust (Mendel *et al.*, 2008) showed that a few psocids occur in the cloud forest, while collecting away from the Peaks at this time provided new data on previously recorded species and led to discovery of one new endemic species.

In 1990 and 1995 Philip and Myrtle Ashmole investigated the invertebrate fauna of lava flows, pyroclastics and volcanic caves on Ascension Island (Ashmole & Ashmole, 1997, 2000a, 2000b). Although psocids had not been found previously on the island, the use of specialised trapping techniques showed that they were actually widespread and diverse in the most barren habitats and led to discovery of a generic endemic species in subterranean habitats. Howard Mendel collected invertebrates on and around Green Mountain in 2003, adding several species to the known fauna, and a little further collecting was done there by the Ashmoles in 2005/06.

Previous knowledge of the psocid fauna of St Helena and Ascension Island has been summarized by Badonnel (1976), Ashmole & Ashmole (1997, 2000a) and Lienhard & Smithers (2002; for corresponding online species lists see Lienhard, 2004b).

Mendel *et al.* (2008) reviewed the data for St Helena, indicating that 22 species of Psocoptera had been recorded up to January 2008, including two unidentified species of the genus *Liposcelis* Motschulsky and three species probably new to science in the genera *Cerobasis* Kolbe, *Sphaeropsocopsis* Badonnel and *Blaste* Kolbe. These new species are described and illustrated in the following. However, the two unidentified species of *Liposcelis* (material deposited in the MHNG) are only mentioned in the checklist (see Appendix) but not treated in this paper. We also publish here for the first time the St Helena records of *Lepinotus inquilinus* and *Liposcelis entomophila*, already listed in the above mentioned report (Mendel *et al.*, 2008), and one recent record of *Stenoacacilius caboverdensis*, a species also known from Ascension Island, raising the final number of species known from St Helena to 23 (see checklist in Appendix).

The psocid fauna of Ascension Island is apparently poorer, but also less investigated, than that of St Helena. The eight species treated by Ashmole & Ashmole (1997) are also listed by Lienhard & Smithers (2002). One of them is an unidentified

*Liposcelis* species, which is mentioned in the checklist (see Appendix) but not treated in the following (material deposited in the MHNG). The *Sphaeropsocopsis* species listed by Ashmole & Ashmole (1997, 2000a) as cf. *microps* is here described as a new species, based on material from St Helena and Ascension Island. The record of *Cerobasis maya* from Ascension Island can now be confirmed; it was previously mentioned as *Cerobasis* cf. *maya* by Ashmole & Ashmole (1997, 2000a). By adding a new species of the genus *Indiopsocus* Mockford, described below, and records of *Cerobasis guestfalica*, *Stenocaecilius caboverdensis*, *Peripsocus leleupi* and *Peripsocus pauliani* we raise the total number of species known from Ascension Island to 13 (see checklist in Appendix).

In the following we present the descriptions of the new species and the new records, together with the first South African record of *Helena tropos abrupta*. Habitus figures are given for the most interesting endemics, the subterranean and troglomorphic *Troglotroctes ashmoleorum* (Ascension Island, Fig. 4a) and *Sphaeropsocopsis myrtleae* (St Helena, Fig. 6a). The 27 psocid species known from St Helena and Ascension Island are listed in the Appendix and treated in a brief biogeographical discussion.

## MATERIAL AND METHODS

Dissection and slide-mounting followed the methods described by Lienhard (1998). The material examined has been deposited in the following institutions: BMNH = The Natural History Museum, London, UK; MHNG = Muséum d'histoire naturelle, Geneva, Switzerland; NMSE = National Museum of Scotland, Edinburgh, UK; SEHU = Systematic Entomology, Hokkaido University, Sapporo, Japan; UNAM = Universidad Nacional Autónoma de México, México City.

The following abbreviations are used in the descriptions: BL = body length (in alcohol); F = hindfemur (length); F+tr = hindfemur and trochanter (length); FW = forewing (length); IO/D = shortest distance between compound eyes divided by anteroposterior diameter of compound eye in dorsal view of head; P1-P4 = articles of maxillary palp; T = hindtibia (length); t1, t2, t3 = tarsomeres of hindtarsus (length, measured from condyle to condyle); V = width of head capsule on vertex.

Bibliographical references of original taxa descriptions not given in this paper can be found in Lienhard & Smithers (2002).

## TAXONOMIC TREATMENT

### TROGIIDAE

#### *Helena tropos abrupta* Lienhard, 2005

Fig. 1

*Helena tropos abrupta* Lienhard, 2005a: 691; description of female from St Helena.

TYPE MATERIAL: MHNG and BMNH, 3 ♀ (holotype and two paratypes), mentioned by Lienhard (2005a).

NEW MATERIAL: MHNG and BMNH, 8 ♂, 11 ♀, South Africa, Cape Town, Table Mountain National Park, mostly from pine plantations, sometimes from "Fynbos" shrubland, collected by leaf litter extraction (12 individuals), pitfall traps (3 ind.), sugar-baited ant traps (3 ind.) and on *Protea* log (1 ind.), leg. C. Uys or C. Uys & M. Picker, May, October, November 2008 and January 2009.

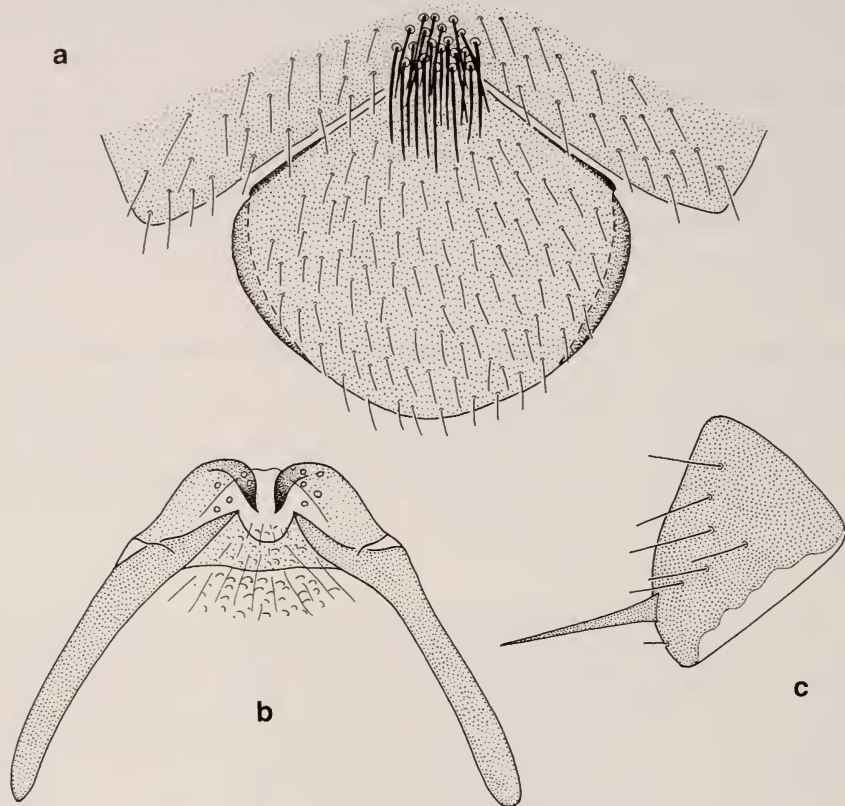


FIG. 1

*Helenatropos abrupta* Lienhard, male: (a) Hypandrium. (b) Phallosome. (c) Right paraproct.

**DESCRIPTION OF MALE:** Colouration and general morphology as described for the female by Lienhard (2005a). Sclerotized metanotal winglet-like lobes of males usually almost touching each other medially as in most females from South Africa and from St Helena [Note: In the holotype figured by Lienhard (2005a: figs 1, 6) these lobes are exceptionally well-separated medially]. Epiproct simple, paraproct nearly triangular (Fig. 1c), its dorsal part sclerotized, its membranous ventral part strongly shortened. Hypandrium heavily sclerotized, basally with a well-developed hypandrial brush, consisting of about 20 acuminate setae (Fig. 1a). Phallosome simple (Fig. 1b), lacking conspicuous internal sclerotizations, parameres distally bifurcate, their posterior part with an anteriorly curved tip. Measurements ( $\delta$  MNHG 7987,  $\mu\text{m}$ ): BL = 1700; F = 330; T = 436; t1 = 130; t2 = 47; t3 = 56.

**DISCUSSION:** This species was tentatively considered as a St Helena endemic by Lienhard (2005a). However, in the discussion of the original description it is mentioned that soil-dwelling psocids of the African continent, at present rather poorly

investigated, could represent a more or less recent source of colonization for the island of St Helena.

During an ecological research project in the Table Mountain National Park numerous specimens of *H. abrupta* were recently collected in South Africa (see material mentioned above). The South African females are identical to the St Helena specimens, therefore both populations have to be assigned to the same species. The existence of this species on the island of St Helena is probably due to introduction from South Africa, probably along with the creeping plant *Carpobrotus edulis* (Aizoaceae) which was brought to St Helena from South Africa in the 19<sup>th</sup> century. The type material was collected on St Helena in pitfall traps set among mats of this creeper.

The monotypic genus *Helenatropos* Lienhard is characterized by a series of striking autapomorphies (see Lienhard, 2005a: 695). The presence of a forked sensillum on P4 in both sexes (see Lienhard, 2005a: fig. 4, 1998: fig. 26i), of a well-developed hypandrial brush (Fig. 1a) and of a simple phallosome with distally bifurcate parameres (Fig. 1b) could indicate a relatively close relationship to the genus *Lepinotus* Heyden. However, the phylogenetic position of *Helenatropos* within the Trogiidae could only be elucidated by careful analysis of the 9 other genera of this family, which is not the purpose of this paper; these genera are listed by Lienhard & Smithers (2002) and Li Fasheng (2002).

*Cerobasis atlantica* Lienhard sp. n.

Fig. 2

HOLOTYPE: MHNG, ♂, St Helena, Earwig Gully, Prosperous Bay Plain, S15°57.459' W5°39.059', ca 290-310m, a gully southeast of the Central Basin, 27.ix.2003, leg. P. & M. Ashmole (site PBP4, sample 79).

PARATYPE: MHNG, ♀ (allotype), St Helena, Cliff Top, S15°57.318' W5°39.873', ca 290-310m, part of the cliff edge east of Prosperous Bay Plain, 27.ix.2003, leg. P. & M. Ashmole (site PBP3, sample 61).

DESCRIPTION: *Colouration*: Body light yellowish white with a small dark brown median patch on pronotum and some tiny brown spots on abdominal tergites, arranged in segmental transversal rows. Compound eyes black, labrum dark brown, flagellomeres apically brown, in distal half of antenna almost completely brown. Winglets unpigmented, no brown transversal tibial rings recognizable on legs.

*Morphology*: Maxillary palp with P4 much enlarged and slightly shorter than P2 (Fig. 2c), lacking forked sensillum. Lacinial tip with three relatively shallow tines (Fig. 2b). Forewing reduced to an oblong winglet, bearing a longitudinal row of 3-5 stout truncate setae in addition to the normal pilosity (Fig. 2a), hindwing absent. Winglets laterally clearly protruding from mesothorax in dorsal view, not covering lateral parts of metanotum as in many other *Cerobasis* species (see Lienhard, 1998: fig. 24b). Therefore dorsal pilosity not only well-developed in middle but also on each lateral 1/3 of metanotum. Mesonotum relatively long (length almost equal to half width of vertex), its hindmargin slightly indented laterally in dorsal view. Pearman's organ of hindcoxa well-developed, hindtibia with 4 terminal spurs and 3 internal spurs in apical half (one hindtibia of the female with 4 internal spurs of normal size and one additional short internal spur close to the apical spurs). Pretarsal claws lacking preapical tooth, with basal appendix and slightly enlarged membranous pulvillus.

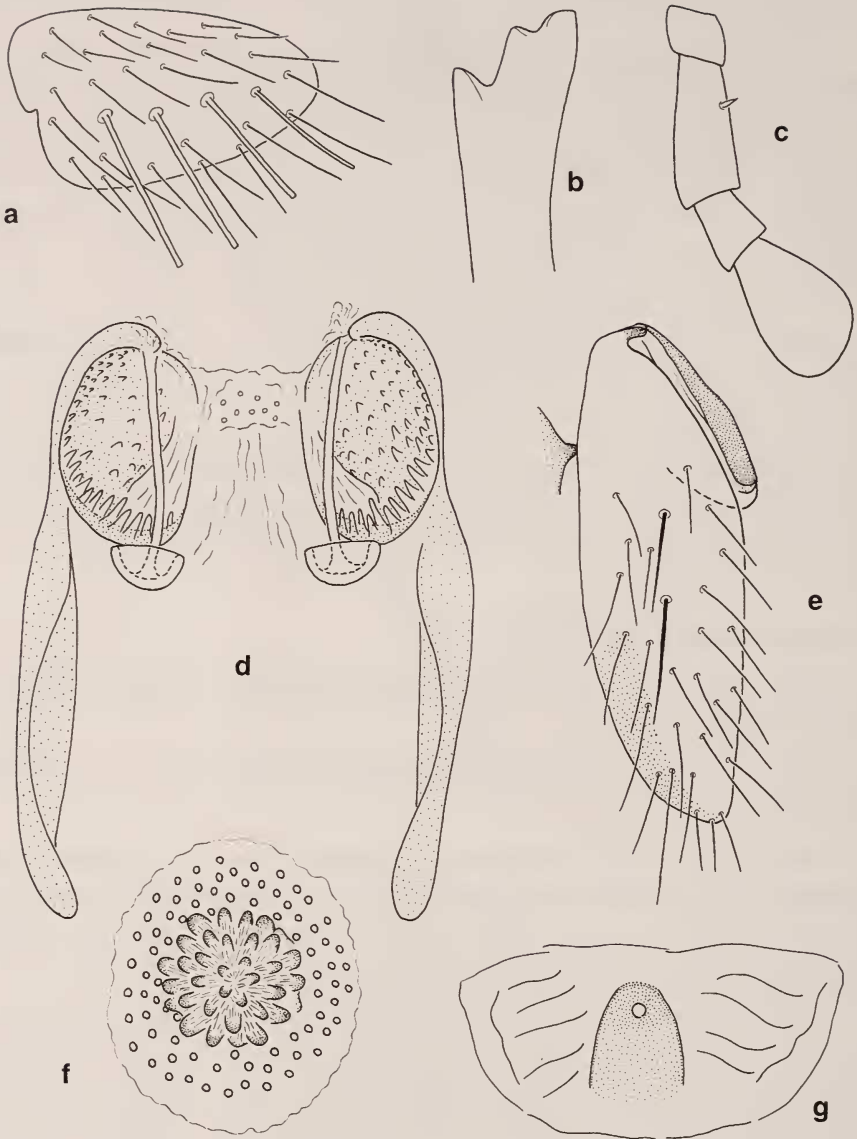


FIG. 2

*Cerobasis atlantica* Lienhard sp. n., male holotype (a-d), female allotype (e-g): (a) Right mesothoracic winglet. (b) Tip of lacinia. (c) Maxillary palp (pilosity not shown, except for spur sensillum of P2). (d) Phallosome. (e) Gonapophyses. (f) Spermathecal parietal gland. (g) Spermapore region.

Hyandrial brush with about 40 acuminate setae. Phallosome as in Fig. 2d, lacking strongly sclerotized internal structures near apex of parameres, mushroom-shaped apodemes well-developed. Female gonapophyses as in Fig. 2e, dorsal valvula

reduced to a short rudiment, external valvula suboval, relatively broad, setose, with two stouter setae about in middle and relatively short apical hairs. Region of spermapore characteristic (Fig. 2g). Both spermathecal parietal glands similar in size, with numerous pores and a central rosette of papillae (Fig. 2f). Spermatheca containing one spermatophore with a very long channel, similar to that of *Cerobasis annulata* figured by Lienhard (1998: fig. 21f).

MEASUREMENTS ( $\mu\text{m}$ ): *Male holotype*: BL = 1370; FW = 180; F = 300; T = 460; t1 = 168; t2 = 52; t3 = 60; length of phallosome = 250. – *Female allotype*: BL = 1510; FW = 220; F = 350; T = 560; t1 = 180; t2 = 56; t3 = 65.

ETYMOLOGY: The specific epithet refers to the distribution of the species on the Atlantic island of St Helena.

DISCUSSION: *Cerobasis atlantica* seems to be endemic to the island of St Helena and has so far been recorded only from Prosperous Bay Plain, an arid habitat. It belongs to a group of species close to the widespread *Cerobasis annulata*, most of which are endemics of one or several Macaronesian islands (see Lienhard, 1984, 1998, 2004b and Lienhard & Smithers, 2002). The new species is easy to distinguish from *C. annulata*, which has also been recorded from St Helena (Badonnel, 1976), by its reduced pigmentation, its more elongate winglets, the presence of 4 terminal spurs on hindtibia (3 in *C. annulata*), the absence of a sclerotized longitudinal internal structure near the apex of the paramere, the structure of the spermapore region and the broad suboval external valvula (for *C. annulata* see description by Badonnel, 1976 and Lienhard, 1998). The structure of the phallosome of *C. atlantica* is similar to that of the Macaronesian species *C. harteni* Lienhard, 1984 (see Lienhard, 1984: fig. 19), known from Cabo Verde and the Azores (Lienhard & Smithers, 2002; Lienhard, 2004b). However, *C. harteni* is completely apterous, lacking Pearman's organ on hindcoxa, with only two apical and two internal spurs on hindtibia and with more elongate external valvulae and a very characteristic spermapore region (see Lienhard, 1984: figs 7 and 18).

### *Cerobasis guestfalica* (Kolbe, 1880)

MATERIAL EXAMINED: BMNH, 1 ♀, Ascension Island, Devil's Cauldron, S7°56' W14°19', 12.viii.2003. leg. H. Mendel (off *Juniperus*).

COMMENT: This widespread and sometimes also domestic species is here recorded for the first time from Ascension Island; it is also known from St Helena (Badonnel, 1976) and from several other Atlantic islands, as Canaries, Azores, Bermudas (see Lienhard & Smithers, 2002).

### *Cerobasis maya* García Aldrete, 1991

Fig. 3

*Cerobasis maya* García Aldrete, 1991: 324; description of male from Mexico.

*Cerobasis* cf. *maya* García Aldrete, 1991. – Ashmole & Ashmole, 1997, 2000a. – Lienhard & Smithers, 2002. – Lienhard, 2004b.

HOLOTYPE (examined): UNAM, ♂, Mexico, Yucatan Peninsula, Quintana Roo, Cancun, 2.xi.1971, on dead hanging fronds of coconut palm, leg. A. N. García Aldrete.

NEW MATERIAL: MHNG, 1 ♂, Ascension Island, Command Hill, 17.-21.iii.1990, leg. N. P. & M. J. Ashmole, trapping on lava (grass cover low, small quantities of several different

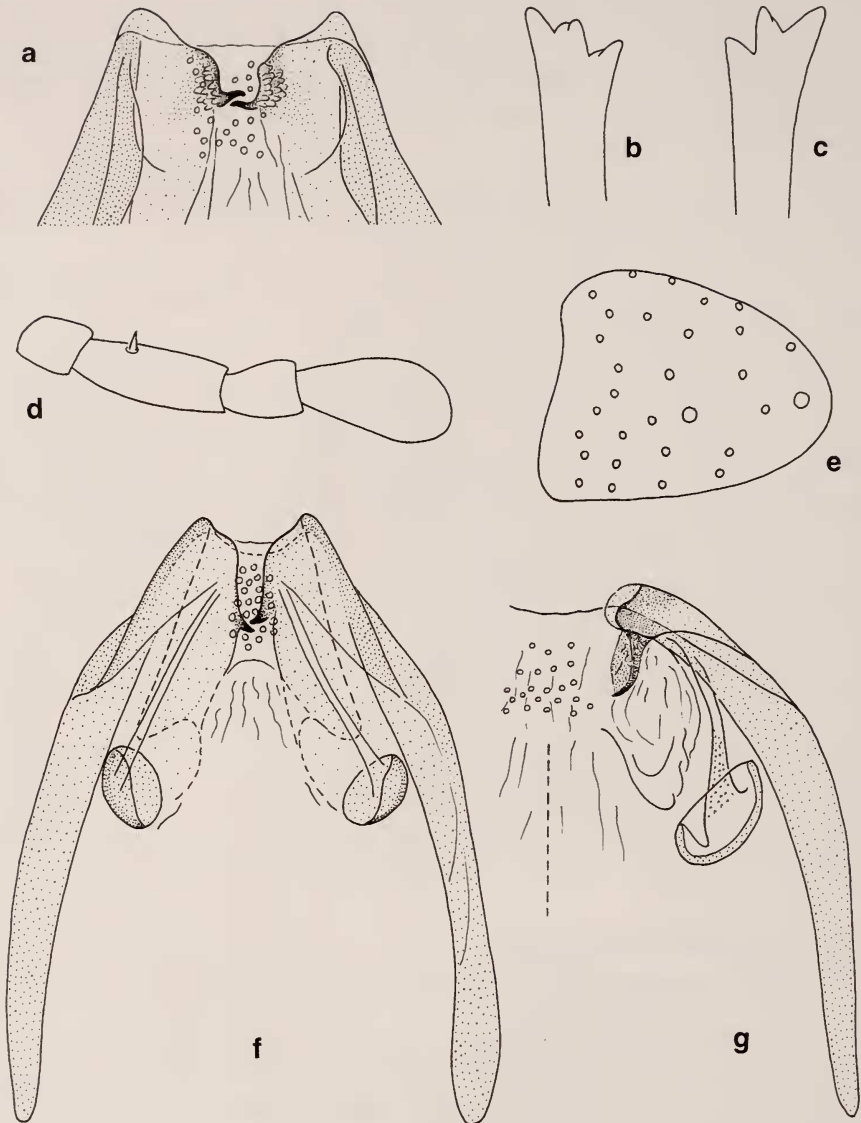


FIG. 3

*Cerobasis maya* García Aldrete, male holotype (a), males from St Helena (b-g): (a) Phallosome, apical part. (b) Tip of left lacinia. (c) Tip of right lacinia (same specimen). (d) Maxillary palp (pilosity not shown, except for spur sensillum of P2). (e) Right mesothoracic winglet with insertion points of setae. (f) Phallosome (closed position). (g) Half of phallosome (open position, axis of symmetry indicated by broken line).

lichens) (sample 0008 Asc). – MHNG, 2♂, Ascension Island, South Gannet Flow, 23.-27.iii.1990, leg. N. P. & M. J. Ashmole, trapping off-lava (thistles, no moss or lichen) (sample 0818 Asc). – BMNH, 1♂, Ascension Island, South Gannet Hill, S7°58' W14°23', 4.viii.2003, leg. H. Mendel (litter, extracted by Winkler apparatus).



DESCRIPTION OF MALE FROM ASCENSION ISLAND: *Colouration*: Not very well preserved. Body yellowish, frons medially with an approximately anchor-shaped brown patch, sometimes subdivided into smaller spots, several other brown spots on head, thorax and abdomen, laterally often fused to form larger patches or bands, winglets hyaline or with some brown pigment (as figured by García Aldrete, 1991: fig. 2). Compound eyes black, basal flagellomeres apically brown (distal half of antennae lost in all specimens examined). Femora with some redbrown hypodermal pigment towards apex, tibiae with two transversal rings of redbrown hypodermal pigment.

*Morphology*: Maxillary palp as in Fig. 3d, P4 lacking forked sensillum. Lacinial tip as shown in Fig. 3b, c (usually both laciniae of same shape, corresponding to Fig. 3c). Forewing reduced to a short winglet bearing 2-3 stout setae in addition to the normal pilosity (Fig. 3e), hindwing absent. Winglets laterally clearly protruding from mesothorax in dorsal view (as figured for the holotype by García Aldrete, 1991: fig. 2), covering only the lateral corners of metanotum, therefore pilosity covering almost all the metanotum, except for 1/6 of its dorsal surface near lateral margin (Note: in many other *Cerobasis* species lateral parts of metanotum extensively covered by winglets and each lateral 1/3 of its dorsal surface lacking pilosity; see Lienhard, 1998: fig. 24c). Mesonotum relatively long (its length about equal to half width of vertex), its hindmargin almost straight in dorsal view. Pearman's organ of hindcoxa well-developed, hindtibia with 4 terminal spurs and 2 internal spurs in apical half (3 internal spurs in one of 8 hindtibiae examined). Pretarsal claws lacking preapical tooth, with basal appendix and slightly enlarged membranous pulvillus. Hypandrial brush with about 60-90 acuminate or slightly truncate setae. Phallosome as in Fig. 3f and Fig. 3g, weakly sclerotized, mushroom-shaped apodemes well-developed, parameres internally with a short pointed process; shape of this process different in closed (Fig. 3f) and open (Fig. 3g) position of the phallosome (see Discussion below).

MEASUREMENTS ( $\mu\text{m}$ ): *Male holotype* (data from García Aldrete, 1991, except for length of phallosome): FW = 113; F = 287; T = 486; t1 = 184; t2 = 50; t3 = 58; length of phallosome = 180. – *Male from Ascension Island* (MHNG 7146): BL = 1260; FW = 120; F = 280; T = 460; t1 = 172; t2 = 47; t3 = 57; length of phallosome = 165.

DISCUSSION: The above mentioned material collected by Philip and Myrtle Ashmole has already been mentioned by these authors as *Cerobasis* cf. *maya* (Ashmole & Ashmole, 1997, 2000a; see also Lienhard & Smithers, 2002 and Lienhard, 2004b). All males from Ascension Island are so similar to the only previously known specimen of *C. maya*, its holotype, that there is no reason to consider them as belonging to a different species or subspecies in spite of some slight differences concerning phallosome morphology. The whole phallosome of the holotype is figured by García Aldrete (1991: fig. 4), details of its distal part are also represented in Fig. 3a (mushroom-shaped apodemes of the parameres not shown in this figure). The comparison with Fig. 3f, g, representing the phallosome of two males from Ascension Island in closed and open position, shows the variable aspects of the apical structures depending on its position after slide-mounting. The position of these parts in Fig. 3f is rather similar to that observed in the slide of the holotype (Fig. 3a). A careful analysis of these structures

in all available males showed that the differences between Fig. 3a and Fig. 3f are largely due to slightly different positions after slide-mounting. The only significant difference between the holotype and the males from Ascension Island is the presence, in the holotype, of a small field of scale-like sculpture on the parameres near the base of the internal process (Fig. 3a and García Aldrete, 1991: fig. 4); this sculpture is absent or only very weakly developed in the males from Ascension Island (Fig. 3f, g). However, compared to usual interspecific differences in phallosome morphology in the genus *Cerobasis*, this extremely slight difference does not justify any taxonomic decision about specific or subspecific separation of the Ascension population, especially in view of the low numbers of individuals available at present.

According to García Aldrete (1991) this species seems to be more closely related to some Macaronesian species than to the other known Mexican species of the genus *Cerobasis*; he mentions the possibility that *C. maya* may have been introduced to Yucatan Peninsula from the Caribbean. Ashmole & Ashmole (1997) tentatively suggested that this species was native to Ascension, but pointed out that it provides one of the rare examples of apparent New World affinities in the Ascension arthropod fauna (see also Biogeographical discussion, below).

#### *Lepinotus inquilinus* Heyden, 1850

MATERIAL EXAMINED: MHNG, 2♀, St Helena, Woodcot, S15°57.2' W5°42.7', ca 489m, 18.ii.2006, leg. P. & M. Ashmole, off laboratory table (sample 2619).

COMMENT: This cosmopolitan and usually domestic species (see Lienhard & Smithers, 2002) is here recorded for the first time from St Helena. As in the case of *Liposcelis entomophila*, this species is undoubtedly introduced to this island (Mendel *et al.*, 2008).

#### LIPOSCOLIDIDAE

#### *Liposcelis entomophila* (Enderlein, 1907)

MATERIAL EXAMINED: MHNG, 2♀, St Helena, Rupert's Battery Cave, ca 50m, 23.ii.2006, leg. P. & M. Ashmole (sample 4444) and 4.xi.2006, leg. E. Thorpe (sample 2821).

COMMENT: This cosmopolitan and often domestic species (see Lienhard & Smithers, 2002) is here recorded for the first time from St Helena. As *Lepinotus inquilinus* (see Mendel *et al.*, 2008) and *Liposcelis bostrychophila* (Fig. 4b) it is undoubtedly introduced to this island. The latter species was erroneously listed as a St Helena endemic by Mendel *et al.* (2008).

#### *Troglotroctes ashmoleorum* Lienhard, 1996

Fig. 4a

*Troglotroctes ashmoleorum* Lienhard, 1996: 118; description of both sexes from Ascension Island.

TYPE MATERIAL: MHNG and NMSE (see Lienhard, 1996).

NEW MATERIAL: MHNG and BMNH, 1♂, 21♀ (most of them heavily damaged), Ascension Island, South Gannet Hill, 17.-30.v.1995, leg. N. P. & M. J. Ashmole, pipe trap inserted vertically ca 2m into lava rubble (sample 0620). See photographs of trap and biotope in Ashmole & Ashmole (2000b: figs 14.5 and 14.6).

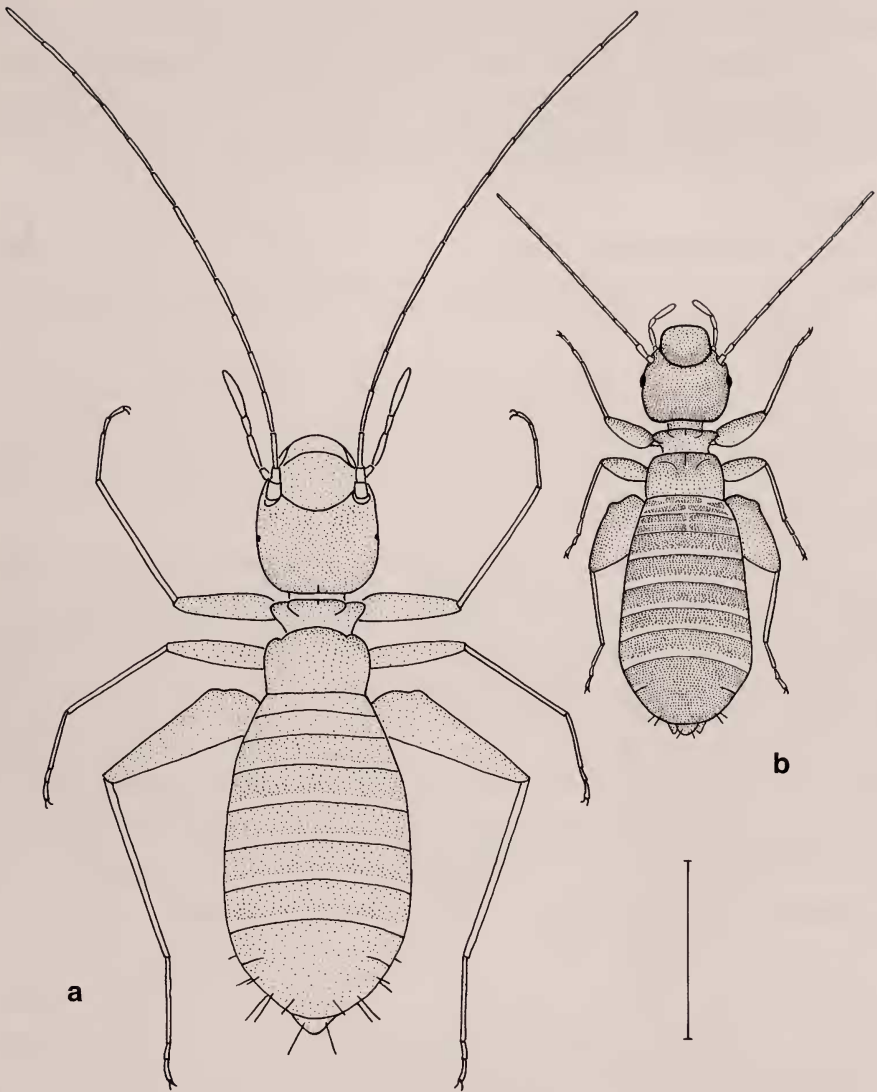


FIG. 4

*Troglotroctes ashmoleorum* Lienhard (a) and *Liposcelis bostrychophila* Badonnel (b), females, to same scale (scale bar: 0.5 mm). The comparison of *T. ashmoleorum* with the habitus of this typical *Liposcelis* species makes evident the troglomorphic habitus of the former (i. e. relatively long legs and antennae, strongly reduced eyes and weakly developed pigmentation).

DISCUSSION: Ashmole & Ashmole (1997, 2002b) already incidentally mentioned this new record, without giving detailed collecting data. This troglomorphic species (Fig. 4a) was originally found in caves (Lienhard, 1996), but the above mentioned individuals were caught in a pipe trap in barren volcanic rubble, suggesting that it is widespread underground. However, a single paratype female was also trapped

in a crevice on barren lava in 1990, so that individuals must sometimes come to the surface, probably at night (Ashmole & Ashmole, 2000b).

*T. ashmoleorum* is closely related to the genus *Liposcelis* (see Lienhard, 1996 and Fig. 4a, b), probably phylogenetically embedded within this large genus (Grimaldi & Engel, 2006); therefore the validity of the monotypic genus *Trogloctroctes* Lienhard has only provisionally been maintained by Yoshizawa & Lienhard (2010).

#### SPHAEROPSOCIDAE

*Sphaeropsocopsis insularum* Lienhard sp. n.

Fig. 5

*Sphaeropsocopsis* cf. *microps* Badonnel, 1963 (one damaged female from Ascension Island, see paratype below). – Ashmole & Ashmole, 1997, 2002a. – Lienhard & Smithers, 2002; Lienhard, 2004b.

HOLOTYPE: MHNG, ♀, St Helena, Rupert's Battery Cave, ca 50m, 25.xi-10.xii.2003, leg. N. P. & M. J. Ashmole, modified pitfall trap ("boot trap") (sample 1835).

PARATYPES: BMNH, 1 ♀, St Helena, Rupert's Battery Cave, ca 50m, 16.ii.2006, leg. N. P. & M. J. Ashmole, modified pitfall trap ("boot trap") (sample 2805). – MHNG, 1 ♀, Ascension Island, Lower Valley Crater, near Northeast Bay, 15-23.v.1995, leg. N. P. & M. J. Ashmole, pipe trap inserted vertically ca 2m into cinders (sample 1107). See photograph of pipe trap in Ashmole & Ashmole (2002b: fig. 14.5).

DESCRIPTION OF FEMALE (male unknown): Head light brown, rest of body whitish brown to yellowish. Hindwings absent, forewings lost in all specimens, their lunulate insertion points visible dorso-laterally near posterior margin of mesothorax (Fig. 5d). Eyes with 3 ommatidia, ocelli absent, frontal suture not visible, vertical suture well-developed, vertex clearly notched in middle (Fig. 5a). Sculpture of vertex consisting of small simple tubercles, mostly arranged into clearly delimited polygonal or scale-shaped areoles (diameter of tubercles slightly smaller than diameter of the alveoli of the small vertical hairs). Antenna with 15 articles (mostly damaged, flagellar sense clubs not observed). Maxillary palp as in Fig. 5a, P4 elongate fusiform, its sub-apical sensory field with 2 long proximal setiform sensilla and 3 similar but somewhat shorter distal sensilla, the latter surrounding 3 club sensilla, two of them slender, the proximal one short and thick, almost spherical (Fig. 5b, c). Labial palp with 3 thin-walled sensilla, the lateral one differentiated as a thick short sense club (Fig. 5i). Lacinial tip bifurcate, inner tine shorter than outer tine, the latter with two small secondary denticles on its inner side (similar to *S. myrtilleae*, see Lienhard & Ashmole, 1999: fig. 5). Sculpture of thoracic tergites similar to that of vertex but areoles absent or indistinct. Mesonotum not subdivided into lobes (Fig. 5d). Legs slender but not particularly long (index T/V = 1.2), no coxal organ present, tibiae with two apical spurs, pretarsal claws with a minute preapical denticle and some ventral microtrichia. Epiproct and paraprocts simple (Fig. 5h). Subgenital plate broader than long, flattened on distal margin, T-shaped sclerite well-developed (Fig. 5e). Gonapophyses typical for the family (see Mockford, 2009), apex of external valvula broadly rounded, not bilobed (Fig. 5g). Region of spermapore with a weakly developed field of small microtrichia (Fig. 5f), spermathecal duct and sac not observed. Measurements (holotype,  $\mu\text{m}$ ): BL = 880; V = 260; F+tr = 285; T = 315; t<sub>1</sub> = 114; t<sub>2</sub> = 32; t<sub>3</sub> = 45.

ETYMOLOGY: The specific epithet, a feminine noun in apposition, refers to the distribution on two South Atlantic islands (island = lat. *insula*; genitive plural: *insularum*).

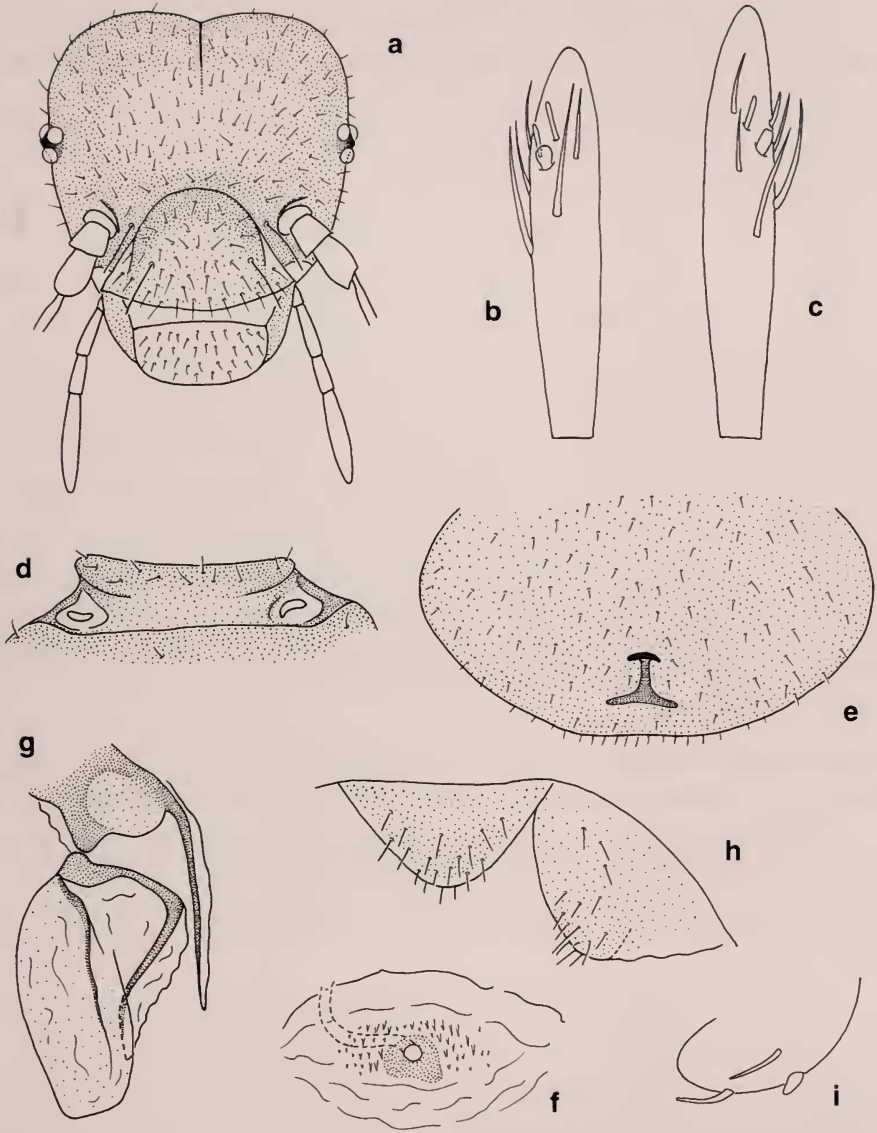


FIG. 5

*Sphaeropsocopsis insularum* Lienhard sp. n., female holotype (c-d, g-i), female paratypes (a-b, from Ascension Island; e-f, from St Helena): (a) Head, frontal view (pilosity of antennae and maxillary palps not shown). (b) P4 of maxillary palp (pilosity not shown, except for subapical sensory field of thin-walled sensilla). (c) Ditto (other specimen and different position). (d) Dorsal view of mesothorax (with insertion points of forewings) and anterior part of wingless metathorax. (e) Subgenital plate. (f) Spermapore region. (g) Gonapophyses. (h) Epiproct and right paraproct. (i) Labial palp (pilosity not shown, except for thin-walled sensilla).

DISCUSSION: The species was previously mentioned from Ascension Island by Ashmole & Ashmole (1997, 2002a) as *Sphaeropsocopsis* cf. *microps*, based on the tentative identification of the damaged paratype female (see above). This specimen had eyes with three ommatidia, a character only known before from the Chilean species *S. microps*. However, this female and the two new females from St Helena, undoubtedly belonging to the same species, clearly differ from the female of *S. microps* by the cuticular sculpture on vertex. In the latter species it consists of large irregularly lobate tubercles which are not arranged into areoles (Badonnel, 1963). Unfortunately forewings are broken and lost in all available specimens of *S. insularum*; however, the insertion point of the forewing (Fig. 5d) is similar to that figured by Badonnel (1963: fig. 59) for *S. chilensis* Badonnel. Thus, the new species is not apterous but has probably elytriform forewings similar to those of *S. microps* and *S. chilensis* (see Badonnel, 1963). The presence of a nearly spherical club sensillum in the subapical P4 sensory field seems to be characteristic of *S. insularum*; the corresponding sensillum of the only known African species of the genus, *S. reisi* Badonnel, is also thick, but much longer (Badonnel, 1971: fig. 5). Without information on morphology of forewing and male genitalia it is impossible to decide if *S. insularum* is more closely related to this African species, as is *S. myrtleae*, the second St Helena species of the genus (see below), or to *S. microps*, which is only known from natural edaphic habitats in Chile (see Badonnel, 1963, 1967). *S. reisi* has eyes with 9 ommatidia (see Badonnel, 1971). However, eye reduction observed in *S. insularum* (3 ommatidia) and *S. microps* (3-4 ommatidia, occasionally 5; see Badonnel, 1963, 1967 and Mockford, 2009) is likely to be due to convergence.

***Sphaeropsocopsis myrtleae* Lienhard & Ashmole, 1999**

Fig. 6

*Sphaeropsocopsis myrtleae* Lienhard & Ashmole, 1999: 907; description of female from St Helena.

HOLOTYPE: MHNG, ♀, St Helena, Rupert's Battery Cave, 13-17.iii.1995, leg. N. P. & M. J. Ashmole, modified pitfall trap ("boot trap") (sample 680 SH).

NEW MATERIAL: MHNG, 1 ♂ 1 ♀, and BMNH, 1 ♀, St Helena, Rupert's Battery Cave, ca 50m, 25.xi-10.xii.2003, leg. N. P. & M. J. Ashmole, modified pitfall trap ("boot trap") (sample 1835).

DESCRIPTION OF MALE: Body and appendages white to yellowish, head capsule very light brown, only sclerotized parts of mandibles dark brown. General morphology as in female (see Lienhard & Ashmole, 1999 and Discussion below) but almost apterous, only small lobes of rudimentary forewings postero-laterally on mesothorax (Fig. 6f), hindwings absent. Maxillary palps lacking (broken), both antennae damaged. Large lateral sense club on labial palp as in female (see Fig. 6d). Legs relatively long (index T/V = 1.5). Epiproct, paraprocts and hypandrium simple. Phallosome as shown in Fig. 6e. Measurements (♂ MHNG 7626,  $\mu\text{m}$ ): BL = 1220; V = 250; F+tr = 304; T = 385; t1 = 130; t2 = 39; t3 = 56.

DISCUSSION: Based on two of the three females known at present, the figure of the head (Fig. 6b) could be completed (see Lienhard & Ashmole, 1999: fig. 1, lacking maxillary palps and some setae) and figures of the sensilla of labial and maxillary palps could be made (Fig. 6c, d). Initially, the absence of subdivision of mesonotum into lobes was the main reason to assign the species to the genus *Sphaeropsocopsis*

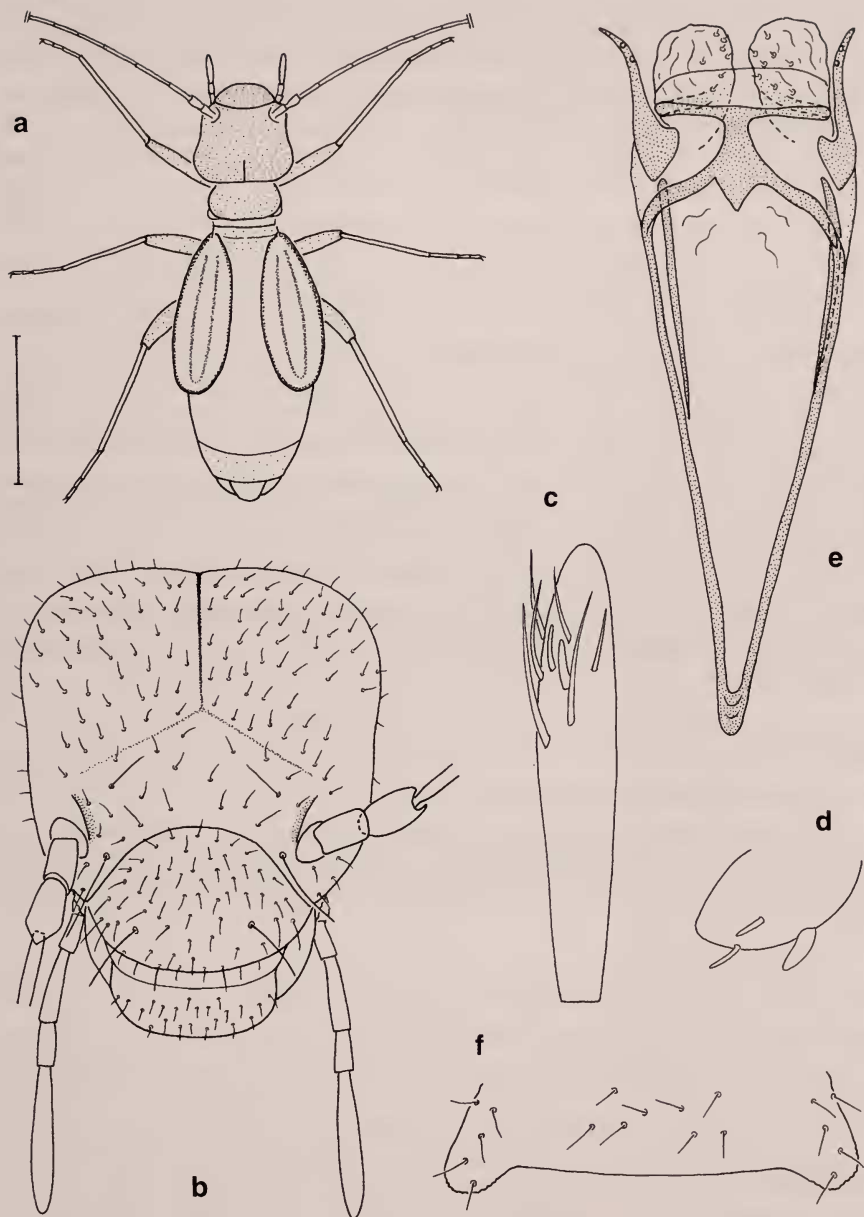


FIG. 6

*Sphaeropsocopsis myrtleae* Lienhard & Ashmole: (a) Habitus of female, dorsal view, antennae incomplete (scale bar: 0.5 mm). (b) Head, frontal view (reconstruction based on two slightly damaged females; pilosity of antennae and maxillary palps not shown). (c) P4 of maxillary palp, female (pilosity not shown, except for subapical sensory field of thin-walled sensilla). (d) Labial palp, female (pilosity not shown, except for thin-walled sensilla). (e) Phallosome. (f) Dorsal view of mesothorax with forewing rudiments, male.

Badonnel and not to *Badonnelia* Pearman (see Lienhard & Ashmole, 1999; erroneously mentioned as "mesothoracic *sternites*" in the Discussion on p. 909). The presence of an elongate fusiform P4 now confirms this assignment (P4 subcylindrical in *Badonnelia*; see Badonnel, 1963). The newly discovered male also confirms the initial generic assignment and allows a better understanding of the origin of this island endemic. The morphology of the phallosome of *S. myrtleae* is very similar to that of the African species *S. reisi* Badonnel, known from Angola (see Badonnel, 1971: fig. 2). However, in *S. reisi* both sexes have well-developed pigmentation and hemispherically prominent eyes of 9 ommatidia. The female of *S. reisi* has elytriform, vaulted forewings reaching the tip of the abdomen and slightly enveloping it laterally (Badonnel, 1971); each forewing bears four longitudinal veins. This type of elytriform forewing is characteristic for the family Sphaeropsocidae (Mockford, 2009). In *S. myrtleae* the forewings are reduced to short narrow membranous flaps, bearing only two longitudinal veins (Fig. 6a). The cave-dwelling *S. myrtleae* is the only blind (anophthalmic) psocid species known at present. Even in forms with reduced compound eyes, as certain species of *Liposcelis*, at least two ommatidia are always present (Lienhard, 1998), except for the troglobitic *Speleopsocus chimanta* Lienhard (Prionoglarididae), recently discovered in a Venezuelan cave, which has only one minute ommatidium on each side of the head (Lienhard *et al.*, 2010). The epigaeic African ancestor of *S. myrtleae* probably colonised St Helena by air and became adapted to subterranean life after reaching the island (Lienhard & Ashmole, 1999; see also Biogeographical discussion, below).

#### CAECILIUSIDAE

##### *Stenocaecilius caboverdensis* (Meinander, 1966)

MATERIAL EXAMINED: BMNH, 1 ♀, St Helena, Cuckhold's Point, S15°58' W5°42', 771m, xii.2005-i.2006, leg. H. Mendel (Malaise trap). – BMNH, 1 ♀ (damaged, lacking abdomen), Ascension Island, Grazing Valley, S7°57' W14°21', viii.2003, leg. H. Mendel (pitfall trap). – BMNH, 1 ♀, Ascension Island, Green Mt., S7°57' W14°21', 6.viii.2003, leg. H. Mendel (vacuum sampler).

COMMENT: This atlanto-mediterranean species is here recorded for the first time from St Helena and Ascension Island. According to Lienhard & Smithers (2002) it is already known from three Macaronesian archipelagoes (Cabo Verde, Azores, Madeira) and from several mediterranean countries (Cyprus, Greece, Israel, Portugal and Tunisia).

#### PERIPSOCIDAE

##### *Peripsocus leleupi* Badonnel, 1976

MATERIAL EXAMINED: BMNH and MHNG, 5 ♀, Ascension Island, Devil's Cauldron, S7°56' W14°19', 12.viii.2003, leg. H. Mendel (off *Juniperus*).

COMMENT: This species was previously considered as a St Helena endemic (Ashmole & Ashmole, 2000a); it is closely related to the African species *Peripsocus ghesquierei* Badonnel (Badonnel, 1976; for distribution see Lienhard & Smithers, 2002).



*Peripsocus pauliani* Badonnel, 1949

MATERIAL EXAMINED: BMNH and MHNG, 6♀, Ascension Island, Devil's Cauldron, S7°56' W14°19', 12.viii.2003, leg. H. Mendel (off *Juniperus*).

COMMENT: This widespread pan-tropical waif (see Lienhard & Smithers, 2002) is here recorded for the first time from Ascension Island; it is also known from St Helena (Badonnel, 1976).

## PSOCIDAE

*Blaste helenae* Lienhard sp. n.

Fig. 7a-f

HOLOTYPE: MHNG, ♂, St Helena, Lot Summit, 454m, off St Helena rosemary *Phylica polifolia*, 29.i.2006, leg. P. & M. Ashmole (sample 4165).

PARATYPES: BMNH 1♂, MHNG 1♀ (allotype) and 1 nymph, same data as for holotype.

DESCRIPTION: General colouration and morphology of both sexes very similar to that described by Badonnel (1976) for *Blaste basilewskyi*, except for less extensive forewing markings (Fig. 7a) and the following characteristics of genital morphology. Hypandrium with a median pair of short but slender terminal processes (Fig. 7d); phallosome on each side with a short outwards-curved hook (Fig. 7c). Subgenital plate of female with a widely opened V-shaped sclerotization, arms of the V relatively slender (Fig. 7f); sclerotization of spermapore region as in Fig. 7e.

MEASUREMENTS: *Male holotype*: BL = 2.2 mm; IO/D = 2.1; FW = 2.5 mm; F = 440 μm; T = 830 μm; t1 = 240 μm; t2 = 150 μm. – *Female allotype*: BL = 2.4 mm; IO/D = 2.6; FW = 2.5 mm; F = 410 μm; T = 780 μm; t1 = 210 μm; t2 = 140 μm.

ETYMOLOGY: The specific epithet refers to the island of St Helena, a British overseas territory in the South Atlantic Ocean, which is named after Saint Helena of Constantinople.

DISCUSSION: This new species is closely related to *Blaste basilewskyi*, the second species of this genus known from St Helena (junior synonym: *Blaste atlantica* New, 1977: 255; see Lienhard & Smithers, 2002: 379). Both species can be assigned to the subgenus *Euclismia* Enderlein (see Badonnel, 1976). *B. helenae* clearly differs from *B. basilewskyi* by less extensive forewing markings in both sexes (see figures of *B. basilewskyi* given by Badonnel, 1976), by smaller hooks of the phallosome (see Fig. 7h and Badonnel, 1976: fig. 173) and by slightly longer and more slender median pair of terminal processes of hypandrium (see Fig. 7g and Badonnel, 1976: fig. 172). Female genitalia of both species are almost identical, except for slight differences concerning the sclerotized area surrounding the spermapore (see Fig. 7i and Badonnel, 1976: figs 174, 175). Measurements of *B. basilewskyi* are rather variable (Badonnel, 1976), those given here for *B. helenae* are close to the lowermost values observed by this author for *B. basilewskyi*, sometimes even lower.

The unique systematic position of *Blaste basilewskyi* within the genus (see Badonnel, 1976; New, 1977) gives no hint on the possible origin of this species, which is common on St Helena and is associated mainly with the endemic gumwoods *Commidendrum* spp., although it has also been found on other plants (Badonnel, 1976 and personal observations). The discovery of *Blaste helenae* on the endemic St Helena rosemary *Phylica polifolia* suggests a niche separation between the two species. *B.*

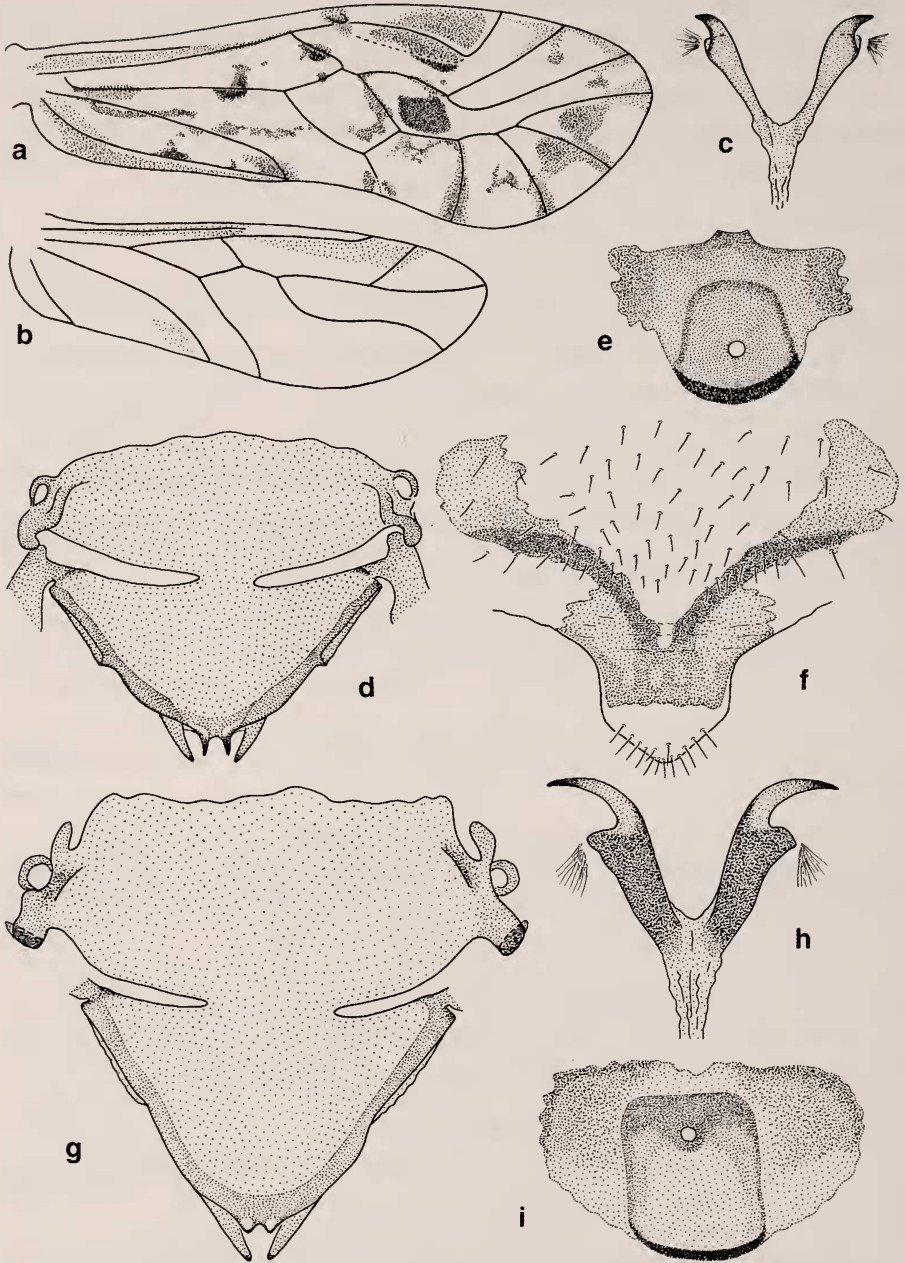


FIG. 7

*Blasté helenae* Lienhard sp. n. (a-d, male holotype; e-f, female allotype): (a) Forewing. (b) Hindwing. (c) Phallosome. (d) Hypandrium, ventral view. (e) Spermapore region. (f) Subgenital plate. — *Blasté basilewkyi* Badonnel (g-i): (g) Hypandrium, ventral view. (h) Phallosome. (i) Spermapore region.

*helenae* was beaten off this plant during the first collecting of invertebrates on the summit of Lot, a massive intrusion of phonolitic rock, exposed by erosion, which forms a striking feature of the landscape of Sandy Bay. Its nearly vertical sides are almost devoid of vegetation but the summit – less than one tenth of a hectare in extent – provides a refuge for a few specimens of *Phylica polifolia*. The rosemary was formerly widespread in dry places in the west of the island but has now been almost entirely lost as a wild tree (Cronk, 2000). Further investigation is needed to determine whether *B. helenae* is also present on any of the other surviving specimens. Badonnel (1976) suggested that *Blaste basilewskyi* may be derived from one of the earliest colonizers of St Helena. Therefore the existence of the apparently much rarer but extremely closely related sister-species *Blaste helenae* on the same island is here tentatively interpreted as a result of sympatric speciation, possibly resulting from adaptation to life on different endemic plants, rather than of double invasion.

***Indiopsocus mendeli* Lienhard sp. n.**

Figs 8-9

HOLOTYPE: MHNG, ♂, Ascension Island, Devil's Cauldron, S7°56' W14°19', 12.viii.2003, leg. H. Mendel (off *Juniperus bermudiana*).

PARATYPES: BMNH, MHNG and SEHU, 19♂, 10♀ (one of them allotype, MHNG 8018), same data as for holotype. – BMNH and MHNG, 11♂, 8♀, Ascension Island, Mt Red Hill, S7°58' W14°21', 14.viii.2003, leg. H. Mendel (off *Tecoma stans*). – BMNH, 1♂, Ascension Island, Mt Red Hill, S7°58' W14°21', 14.viii.2003, leg. H. Mendel. – BMNH, 1♀, Ascension Island, Devil's Ashpit, S7°57' W14°13', 2.viii.2003, leg. H. Mendel (vacuum sampler).

DESCRIPTION: *Colouration*: Head and thorax pale brown, with dark brown markings, postclypeus with brown longitudinal stripes, antenna brown, compound eye black, legs yellowish to medium brown. Maxillary palp with P1 and P2 very light brown, P3 and P4 darker brown, apical half of P4 blackish brown. Forewing pattern slightly sexually dimorphic, with more extensive brown markings in female (Fig. 8f) than in male (Fig. 8a), especially in basal half of the wing. Abdomen whitish, with some red-brown hypodermal pigment, in particular laterally, terminalia dark brown. In male, membranous zone anteriorly to hypandrium on each side with a brown sclerotized patch (Fig. 9a), sometimes not very distinct.

*Morphology*: Compound eyes very large and prominent in male, distinctly smaller in female (see IO/D values, below), ocelli well-developed. Wing venation as in Fig. 8a, b, f; posterior apex of pterostigma with a very short and sometimes weakly developed spur vein.

Male terminalia (Fig. 9): Posterior margin of clunium medially slightly prominent and overlapping base of epiproct (Fig. 9d), the latter hemicircular, basally on each side with a well-sclerotized swelling (Fig. 9a, d). Paraproct with a short lateral protuberance, a pointed apical process and a small setose protuberance basally of the latter; trichobothria forming an arched, posteriorly open sense cushion (Fig. 9a, d). Medio-distal protuberance of hypandrium slightly asymmetrical, subdivided into a few pustulate or denticulate lobes, partly weakly but mostly heavily sclerotized (Fig. 9a, c). Phallosome basally broad and truncate, distally with a pair of lateral lobiform and weakly sclerotized processes and three well-sclerotized subacute apical processes of almost equal length, separated by two narrow V-shaped indentations (Fig. 9b).

Female terminalia: Posterior margin of clunium straight, epiproct and paraprocts simple, as usual in the family. Subgenital plate as in Fig. 8d, basal sclerotization

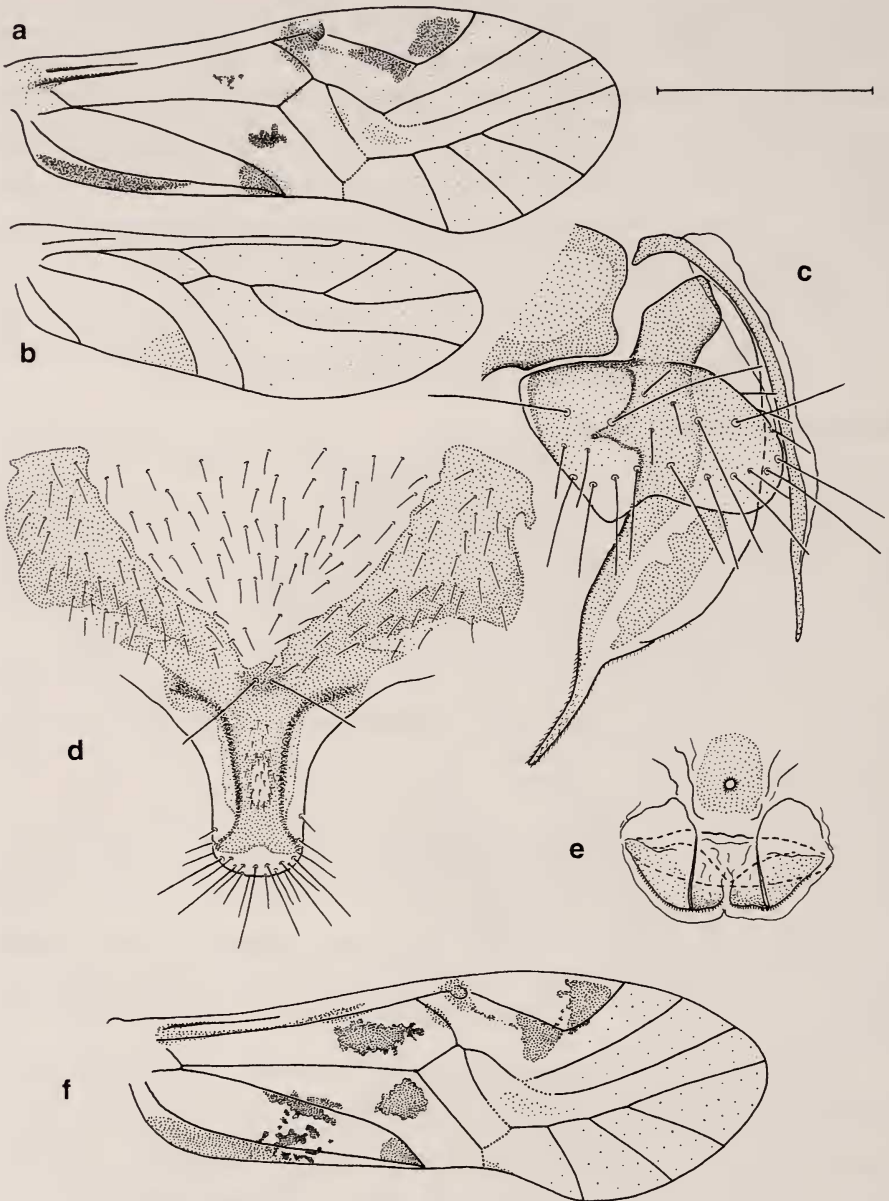


FIG. 8

*Indiopsocus mendeli* Lienhard sp. n.: (a) Forewing, male (scale bar: 1 mm). (b) Hindwing, male (to same scale). (c) Gonapophyses, female. (d) Subgenital plate, female. (e) Spermapore region, female. (f) Forewing, female (to same scale as Fig. 8a, b).

V-shaped, median zone of apical lobe particularly well-sclerotized on each side. Gonapophyses and region of spermapore as in Fig. 8c, e; posterior lobe of external valvula inconspicuous.

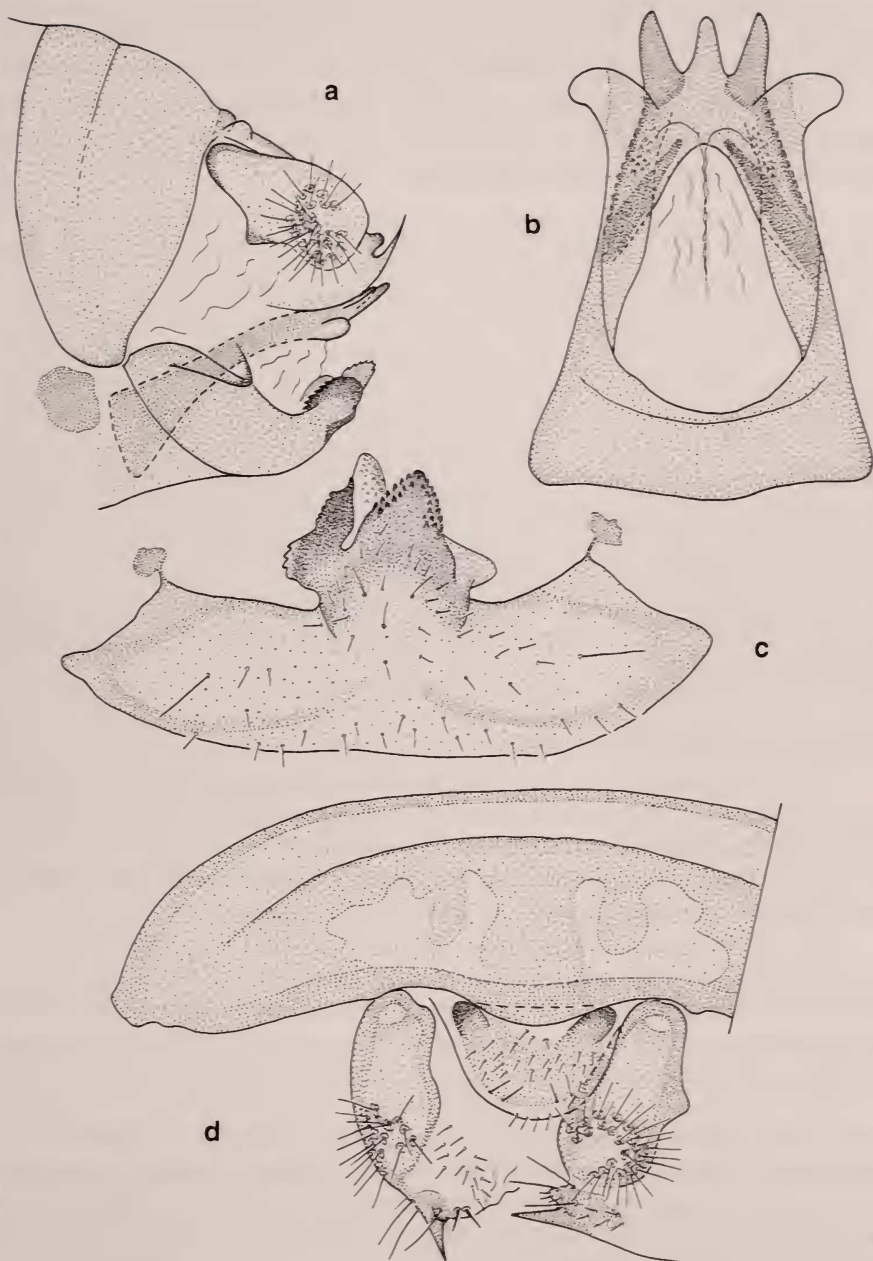


FIG. 9

*Indiopsocus mendeli* Lienhard sp. n., male: (a) Abdominal apex, lateral view (pilosity not shown, except for paraproctal trichobothria). (b) Phallosome. (c) Hypandrium, posterior view (slightly squashed). (d) Clunium, epiproct and paraprocts (dorsal view, pilosity partially omitted, paraprocts in different position).

MEASUREMENTS: *Male holotype*: BL = 2.0 mm; IO/D = 0.9; FW = 2.75 mm; F = 590  $\mu\text{m}$ ; T = 1200  $\mu\text{m}$ ; t1 = 436  $\mu\text{m}$ ; t2 = 143  $\mu\text{m}$ . – *Female allotype*: BL = 2.1 mm; IO/D = 1.7; FW = 2.95 mm; F = 590  $\mu\text{m}$ ; T = 1240  $\mu\text{m}$ ; t1 = 414  $\mu\text{m}$ ; t2 = 144  $\mu\text{m}$ .

ETYMOLOGY: The specific epithet refers to the collector of the type material, Howard Mendel (BMNH), in recognition of his important contributions to scientific study of St Helena and Ascension Island fauna.

DISCUSSION: The new species is closely related to *Indiopsocus dentatus* (Thornton & Woo, 1973), which is only known from the Galapagos Islands (Thornton & Woo, 1973; Lienhard & Smithers, 2002). The forewing pattern of the female of *I. dentatus* (see Thornton & Woo, 1973: fig. 77) is very similar to that figured here for the male of *I. mendeli* (Fig. 8a), while in the female of the latter some additional dark markings are usually visible in the basal half of the wing (Fig. 8f). Female genitalic characters of both species are very similar (see Thornton & Woo, 1973: figs 78, 79; the spermapore region of *I. dentatus* is not known). However, these species are easy to distinguish by the different shape of the apical lobes of the hypandrium and especially of the terminal processes of the phallosome (see Thornton & Woo, 1973: figs 80-82); in particular, the two deep indentations between the three mediodistal processes of the phallosome are broadly U-shaped in *I. dentatus*.

After the above treated *Cerobasis maya* this is the second example of apparent New World affinities in the Psocoptera fauna of Ascension Island (see also Biogeographical discussion).

## BIOGEOGRAPHICAL DISCUSSION

The psocopteran fauna of St Helena and Ascension Island is now fairly well known (St Helena: 23 spp.; Ascension: 13 spp.; see checklist in Appendix and comments in Introduction). Detailed data (up to the year 2000) on the general distribution of the non-endemic species can be found in Lienhard & Smithers (2002) and more recent additional data in Lienhard (2003-2011, in *Psocid News*).

Several species have probably been introduced by human activities, such as the following widespread (in some cases cosmopolitan) and often domestic species of the suborders Trogiomorpha and Troctomorpha: *Cerobasis annulata* (St Helena), *C. guestfalica* (St Helena, Ascension), *Lepinotus inquilinus* (St Helena), *Psocathropos lachlani* (Ascension), *Psyllipsocus ramburii* (St Helena, Ascension), *Liposcelis bostrychophila* (St Helena, Ascension), *L. entomophila* (St Helena). The cosmopolitan and sometimes domestic Psocomorpha species *Ectopsocus briggsi* (St Helena) belongs probably also to this category. Furthermore, the recently discovered species *Helena tropis abrupta*, initially described as endemic to St Helena but later also found in Table Mountain National Park, Cape Town, was probably also introduced to the island from South Africa (see Taxonomic treatment).

One widespread tropical waif, *Peripsocus pauliani* (St Helena, Ascension), and the following predominantly Western Palaearctic species with atlanto-mediterranean distribution, known also from Macaronesian archipelagoes, have probably reached these South Atlantic islands by natural dispersal: *Stenocaeceilius caboverdensis* (St Helena, Ascension), *Ectopsocus strauchi* (St Helena, Ascension), *Trichopsocus clarus*

(St Helena), *Myopsocus eatoni* (St Helena). The case of the Mexican species *Cerobasis maya*, at present only known from Ascension Island and the Yucatan Peninsula, is more puzzling, in view of the unfavourable conditions for trans-Atlantic dispersal of insects from west to east (Ashmole & Ashmole, 1997); anthropogenic distribution due to introduced plants or phoretic dispersal by seabirds cannot be excluded (some *Cerobasis* species are known to live occasionally in birds' nests, e. g. *C. guestfalica*, see Lienhard, 1986).

Two species occur on both islands, St Helena and Ascension, without being known from elsewhere: *Sphaeropsocopsis insularum* Lienhard sp. n. and *Peripsocus leleupi*. This could be due to independent invasion from the same origin (Africa for *P. leleupi*, unknown for *S. insularum*; see Taxonomic treatment) or to natural dispersal or human-assisted transfer from one island to the other.

The following six species can be considered as St Helena endemics (see Ashmole & Ashmole, 2000a and Mendel *et al.*, 2008, but note that the cosmopolitan and often domestic species *Liposcelis bostrychophila* was accidentally listed as an endemic in the 2008 report, and that the species *Peripsocus leleupi* has now also been recorded on Ascension Island, see above): *Cerobasis atlantica* Lienhard sp. n., *Sphaeropsocopsis myrtleae*, *Stenocaecilius benoiti*, *Peripsocus decellei*, *Blaste basilewskyi* and *Blaste helenae* Lienhard sp. n. *Cerobasis atlantica* belongs to a species group containing several Macaronesian endemics (see description, above), while *Sphaeropsocopsis myrtleae*, *Stenocaecilius benoiti* and *Peripsocus decellei* are related to African species (see Badonnel, 1976 and Taxonomic treatment, above). The existence of two very closely related endemic sister-species of unknown origin, *Blaste basilewskyi* and *B. helenae*, is here tentatively interpreted as a result of sympatric speciation (see description of *B. helenae*, above).

Two species can be considered as endemics of Ascension Island, *Troglotroctes ashmoleorum* and *Indiopsocus mendeli* Lienhard sp. n. The latter is closely related to *I. dentatus*, only known from Galapagos islands (see description, above); together with *Cerobasis maya* it provides one of the few examples of apparent New World affinities in the Ascension and St Helena arthropod fauna (Ashmole & Ashmole, 1997). As mentioned above for *C. maya*, an anthropogenic introduction of *I. mendeli* cannot be excluded. The plants on which the species has been found on Ascension Island (*Juniperus bermudiana* and *Tecoma stans*) are widely planted and sometimes invasive in many parts of the Pacific. Thus *I. mendeli* is clearly a species associated with introduced plants.

The subterranean and troglomorphic species *Troglotroctes ashmoleorum* (Ascension, Fig. 4a) and *Sphaeropsocopsis myrtleae* (St Helena, Fig. 6a) are among the most interesting endemic arthropods of these South Atlantic islands, being the only known members of the suborder Troctomorpha with clear morphological adaptations to subterranean life. The adaptations presumably evolved after arrival of the ancestral forms respectively on Ascension Island and St Helena. The case of *Troglotroctes* is especially interesting in view of the relatively recent origin of Ascension Island (around one million years ago). This species is one of a small but taxonomically diverse group of arthropods on that island which demonstrate the relatively rapid evolution of troglomorphic characteristics (Ashmole & Ashmole, 1997: 570).

*Sphaeropsocopsis myrtleae*, from the much older island of St Helena, may be derived from a lineage that reached it in the distant past. This species is especially significant since it provides almost the only piece of evidence of the existence on this island of a highly adapted subterranean fauna (Lienhard & Ashmole, 1999). Ancient volcanic terrain tends to lack specialised subterranean fauna because weathering of volcanic habitats over long periods leads to the silting up of cracks and superficial underground spaces, preventing the inflow of nutrients to deeper layers and ultimately sealing caves, so that they may become sterile. Nearer the surface, the formation of soil and growth of vegetation leads to faunal succession (Ashmole *et al.*, 1992) and any caves where life might persist tend to be inaccessible. On St Helena this process has led to dominance of introduced species in the soil and the remaining subsurface spaces (Ashmole & Ashmole, 2000a: 131-132). Rupert's Battery Cave, where *S. myrtleae* was found, was the only lava tube to which we could gain access sufficient to sample even the most superficial parts of a cave environment.

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**APPENDIX:** Checklist of Psocoptera species known from St Helena and Ascension Island (arrangement of suborders and families according to Lienhard & Smithers, 2002; for species groups of *Liposcelis* see Lienhard, 1998; \* = island endemic)

	ST HELENA	ASCENSION ISLAND
TROGIOMORPHA		
Trogiidae	<i>Cerobasis annulata</i> (Hagen, 1865) * <i>Cerobasis atlantica</i> Lienhard sp. n. <i>Cerobasis guestfalica</i> (Kolbe, 1880)  <i>Helenatropos abrupta</i> Lienhard, 2005 <i>Lepinotus inquilinus</i> Heyden, 1850	<i>Cerobasis guestfalica</i> <i>Cerobasis maya</i> Garcia Aldrete, 1991
Psyllipsocidae	<i>Psyllipsocus ramburii</i> Selys-Longchamps, 1872	<i>Psocathropos lachlani</i> Ribaga, 1899 <i>Psyllipsocus ramburii</i>
TROCTOMORPHA		
Liposcelididae	<i>Liposcelis bostrychophila</i> Badonnel, 1931 <i>Liposcelis entomophila</i> (Enderlein, 1907) <i>Liposcelis</i> spec. (species group A) <i>Liposcelis</i> spec. (species group C)	<i>Liposcelis bostrychophila</i>   <i>Liposcelis</i> spec. (species group C) * <i>Troglotroctes ashmoleorum</i> Lienh., 1996
Sphaeropsocidae	<i>Sphaeropsocopsis insularum</i> Lienhard sp. n. * <i>Sphaeropsocopsis myrtleae</i> Lienh. & Ashm., 1999	<i>Sphaeropsocopsis insularum</i>

## PSOCOMORPHA

- Caeciliusidae    \**Stenocaecilius benoiti* (Badonnel, 1976)  
                   *Stenocaecilius caboverdensis* (Meinander, 1966)                    *Stenocaecilius caboverdensis*
- Ectopsocidae    *Ectopsocus briggsi* McLachlan, 1899  
                   *Ectopsocus strauchii* Enderlein, 1906                    *Ectopsocus strauchii*
- Peripsocidae    \**Peripsocus decellei* Badonnel, 1976  
                   *Peripsocus leleupi* Badonnel, 1976                    *Peripsocus leleupi*  
                   *Peripsocus pauliani* Badonnel, 1949                    *Peripsocus pauliani*
- Trichopsocidae    *Trichopsocus clarus* (Banks, 1908)
- Psocidae        \**Blaste basilewskyi* Badonnel, 1976  
                   \**Blaste helenae* Lienhard sp. n.                    \**Indiopsocus mendeli* Lienhard sp. n.
- Myopsocidae    *Myopsocus eatoni* McLachlan, 1880